National Sustainable Agriculture Coalition

# Climate Change and Agriculture Recommendations for Farm Bill Conservation Program Implementation

The National Sustainable Agriculture Coalition (NSAC)[1] submits the following recommendations on proactive steps that can be taken through farm bill conservation program implementation to support climate change adaptation and mitigation in the agriculture sector. These recommendations reflect the reality of the relationship between climate change and agriculture,[2] the President's priority to address climate change,[3] and the U.S. Department of Agriculture's role[4] both to enhance support for those practices and systems with the greatest adaptation and mitigation potential and to encourage the transition away from those with negative climate effects and less ability to cope with the pressure imposed by increasingly extreme and unpredictable weather events.

As the recent National Climate Assessment found:

> Some areas [of the U.S.] are already experiencing climate-related disruptions, particularly due to extreme weather events. While some U.S. regions and some types of agricultural production will be relatively resilient to climate change over the next 25 years or so, others will increasingly suffer from stresses due to extreme heat, drought, disease, and heavy downpours. From mid-century on, climate change is projected to have more negative

---

[1] NSAC's 40 represented members include: Agriculture and Land-Based Training Association - Salinas, CA; Alternative Energy Resources Organization - Helena, MT; California Certified Organic Farmers - Santa Cruz, CA; California FarmLink - Santa Cruz, CA; C.A.S.A. del Llano (Communities Assuring a Sustainable Agriculture) - Hereford, TX; Center for Rural Affairs - Lyons, NE; Clagett Farm/Chesapeake Bay Foundation - Upper Marlboro, MD; Community Alliance with Family Farmers - Davis, CA; Dakota Rural Action - Brookings, SD; Delta Land and Community, Inc. - Almyra, AR; Ecological Farming Association -Soquel, CA; Farmer-Veteran Coalition - Davis, CA; Fay-Penn Economic Development Council - Lemont Furnace, PA; Flats Mentor Farm - Lancaster, MA; Florida Organic Growers - Gainesville, FL; GrassWorks - New Holstein, WI; Hmong National Development, Inc. - St. Paul, MN and Washington, DC; Illinois Stewardship Alliance - Springfield, IL; Institute for Agriculture and Trade Policy - Minneapolis, MN; Iowa Natural Heritage Foundation - Des Moines, IA; Izaak Walton League of America - St. Paul, MN/Gaithersburg, MD; Kansas Rural Center - Whiting, KS; The Kerr Center for Sustainable Agriculture - Poteau, OK; Land Stewardship Project - Minneapolis, MN; Michael Fields Agricultural Institute - East Troy, WI; Michigan Food & Farming Systems (MIFFS) - East Lansing, MI; Michigan Organic Food and Farm Alliance - Lansing, MI; Midwest Organic and Sustainable Education Service - Spring Valley, WI; National Catholic Rural Life Conference - Des Moines, IA; The National Center for Appropriate Technology - Butte, MT; Nebraska Sustainable Agriculture Society - Ceresco, NE; Northeast Organic Dairy Producers Alliance -Deerfield, MA; Northern Plains Sustainable Agriculture Society - LaMoure, ND; Northwest Center for Alternatives to Pesticides - Eugene, OR; Ohio Ecological Food & Farm Association - Columbus, OH; Organic Farming Research Foundation - Santa Cruz, CA; Rural Advancement Foundation International – USA - Pittsboro, NC; Union of Concerned Scientists Food and Environment Program - Cambridge, MA; Virginia Association for Biological Farming - Lexington, VA; Wild Farm Alliance -Watsonville, CA. The following participating members also support this document: California Climate & Agriculture Network – Sacramento, CA; Defenders of Wildlife – Washington, DC; Iowa Environmental Council – Des Moines, IA.

[2] *See e.g.* Melillo, JM, TC Richmond, and GW Yohe (eds.). 2014. Highlights of Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program.

[3] The President's Climate Action Plan, Executive Office of the President, June 2013; Executive Order 13653 Preparing the United States for the Impacts of Climate Change, 78 Fed. Reg. 66819 (Nov. 6 2013).

[4] US Department of Agriculture Climate Change Adaptation Plan, June 2012; USDA Natural Resources Conservation Service Climate Change Vulnerability Assessment and Adaptation Plan, May 2012.

110 Maryland Avenue NE, Suite 209 • Washington, DC 20002-5622
p (202) 547-5754 f (202) 547-1837 • http://sustainableagriculture.net

impacts on crops and livestock across the country – a trend that could diminish the security of our food supply.[5]

Notably, a 2013 USDA report found that sustainable agriculture practices and systems can improve the ability of agriculture to adapt to a rapidly changing climate. The report states:

> Adaptation measures such as . . . diversifying crop rotations, integrating livestock with crop production systems, improving soil quality, minimizing off-farm flow of nutrients and pesticides, and other practices typically associated with sustainable agriculture are actions that may increase the capacity of the agricultural system to minimize the effects of climate change on productivity. For example . . . production practices that enhance the ability of healthy soils to regulate waters resource dynamics at the farm and watershed scales will be particularly critical for the maintenance of crop and livestock productivity under conditions of variable and extreme weather events. *Enhancing the resilience of agriculture to climate change through adaptation strategies that promote the development of sustainable agriculture is a common multiple-benefit recommendation for agricultural adaptation.*[6]

Although our national agricultural production systems are not the primary source of greenhouse gas (GHG) emissions, changes in agricultural practices can help farmers and ranchers not only adapt to the consequences of GHG emissions, but also mitigate them. In particular, low input and biologically diverse agricultural systems, including certified organic agriculture, play an important role in addressing climate change. In addition to their ability to reduce GHG emissions and sequester carbon, these complex systems produce numerous co-benefits that will help farmers build resilient and viable systems of production.

President Obama has made it clear that the agencies have a role to play in facilitating adaptation to climate change across economic sectors, including agriculture. Under Executive Order 13653, the agencies shall:

> (i) identify and seek to remove or reform barriers that discourage investments or other actions to increase the Nation's resilience to climate change while ensuring continued protection of public health and the environment;
> (ii) reform policies and Federal funding programs that may, perhaps unintentionally, increase the vulnerability of natural or built systems, economic sectors, natural resources, or communities to climate change related risks; and
> (iii) identify opportunities to support and encourage smarter, more climate- resilient investments by States, local communities, and tribes, including by providing incentives through agency guidance, grants, technical assistance, performance measures, safety considerations, and other programs.

The Executive Order additionally directs agencies to "focus on program and policy adjustments that promote the dual goals of greater climate resilience and carbon sequestration, or other reductions to the sources of climate change."[7]

---

[5] Melillo et al. at 46 (emphasis added).
[6] USDA Climate Change and Agriculture in the United States: Effects and Adaptation, CCPO Technical Bulletin 1935 at 6, Feb. 2013 (emphasis added).
[7] 78 Fed. Reg. 66819, 66820 (Nov. 6 2013).

USDA's Natural Resources Conservation Service (NRCS) is at the forefront to help realize the President's vision for a more resilient U.S. agriculture system. At a stakeholder briefing on farm bill implementation, Secretary Vilsack was asked how implementation activities would address the nexus between climate change and agriculture. We were pleased that the Secretary pointed to NRCS conservation programs as the existing tools that USDA has to address climate change mitigation and adaptation under its farm bill authority. We wholeheartedly agree, and provide below recommendations for actions that NRCS can take to address climate change adaptation and mitigation through the implementation of farm bill conservation programs.

## Sustainable Agriculture Principles for Addressing Climate Change Adaptation and Mitigation through NRCS Conservation Programs

Our recommendations are based on eight broad principles:

(1) NRCS should promote energy conservation, increased energy efficiency, and on-farm solar, wind, and other renewable energy production as ways to mitigate agricultural greenhouse gas emissions and increase resiliency.

(2) NRCS should assist producers, especially livestock farmers and ranchers, in the transition to systems that keep the land in sod and other perennial vegetation, and should support rangeland management that promotes climate benefits.

(3) NRCS conservation programs should prioritize farming systems and conservation activities that build soil organic matter, increase carbon sequestration, and prevent denitrification.

(4) NRCS should promote farmscaping that supports resilience to a changing climate and promotes carbon sequestration in woody biomass and soils.

(5) NRCS should encourage practices that reduce methane emissions, especially in livestock systems.

(6) NRCS should prioritize conservation easements on lands that currently provide climate benefits, including increased carbon sequestration and avoided greenhouse gas emissions, and that are most at risk of conversion to development or transportation uses that would greatly increase net greenhouse gas emissions.

(7) When promoting conservation activities for their climate change benefits, NRCS should ensure that both the adaptation and mitigation benefits are assessed and appropriately reflected.

(8) In the implementation of conservation programs, NRCS should account for and work to reduce the impacts of climate change on terrestrial and aquatic habitats and ecosystem services, such as clean air and water.

## Recommendations to Advance Each of these Principles

**(1) NRCS should promote energy conservation, increased energy efficiency, and on-farm solar, wind, and other renewable energy as ways to mitigate agricultural greenhouse gas emissions and increase resiliency.**

Reducing unnecessary use of energy is common sense, saves money, and helps the environment. NRCS programs can help farmers and ranchers cope with climate changes by emphasizing energy conservation measures and increased energy efficiency for on-farm activities.

A prime example is to encourage farmers to incorporate nitrogen-fixing plants into crop rotations and pastures to provide nitrogen and reduce synthetic fertilizer use. This can eliminate the fossil fuel used to produce synthetic fertilizer, reduce $N_2O$ emissions from synthetic fertilizer applications, and help farmers cope with the increasing spikes and volatility in the costs of synthetic fertilizer.

Other examples include reduced farm machinery use (e.g. less tillage, which means fewer tractor passes through the field), reduced fuel used to transport bulk materials onto the farm, no or reduced use of industrially-fixed N fertilizer (high embodied energy), and reduction in other inputs whose manufacture is energy-intensive, like pesticides.

*Recommendation:* Integrate climate and energy issues into conservation planning. This can be done through several channels: (1) expanding the Energy Resource Concern to "Energy Conservation and Greenhouse Gas Reduction;" (2) including climate and GHG considerations when assigning environmental benefit scores to conservation activities in the Conservation Stewardship Program (CSP) and to CPPE scoring more broadly; and (3) incorporating on-farm energy audits into comprehensive conservation planning. Regarding this last point, the 2014 Farm Bill authorizes NRCS to provide financial and technical assistance for comprehensive conservation planning as part of a CSP contract. We recommend that the comprehensive conservation plan specifically include a climate adaptation and mitigation plan that demonstrates on-farm benefits, including energy savings.

*Recommendation:* Coordinate across USDA agencies to connect producers with the resources they need to assist in the development of on-farm energy resources, especially solar and wind, but also perennial biomass crops for bioenergy feedstocks and small-scale bioenergy digesters. In addition to working with producers on energy projects through conservation programs, NRCS should be equipped to provide producers with information regarding resources available through sister agencies, such as the Rural Energy for America Program and the Biomass Crop Assistance Program.

**(2) NRCS should assist producers, especially livestock farmers and ranchers, in the transition to systems that keep the land in sod and other perennial vegetation, and should support rangeland management that promotes climate benefits.**

Protecting grassland, prairie, pasture-based agricultural systems, agroforestry and silvocuture systems such as permaculture, and converting row crop systems to grass-based or other perennial systems can provide for significant levels of retained and newly sequestered soil carbon. This involves not only preventing the breaking of native grassland, prairie, or forest for crop production, but encouraging the conversion of existing cropland to pasture-based or other perennial systems.

Sustainable management of rangelands can be an effective tool for carbon sequestration and GHG emission reductions. When managed correctly, cattle grazing can increase above ground productivity of vegetation and species richness,[8] which is frequently correlated with increased carbon in the soil.[9] When properly managed, grazing has also been found to increase the rate of soil carbon sequestration.[10] Rotational grazing, a practice of intensively grazing and rotating livestock through paddocks, has the potential to increase carbon sequestration by 15 to 30 percent.[11] In a study modeling the impacts of various dairy and beef management practices, it was estimated that intensive grazing and rotation through paddocks increased carbon sequestration by 10 percent, and increased to 15 to 30 percent when combined with improved production efficiency and no-till feed production.[12] Converting fields from conventionally raised feedstock to perennial grasslands for grazing can sequester up to 3,400 pounds of carbon dioxide equivalent per acre each year.[13]

*Recommendation:* Work collaboratively with the Farm Service Agency to engage in extensive outreach with retiring Conservation Reserve Program landowners to enroll in the Conservation Stewardship Program and transition those lands to grass-based and other perennial agriculture systems and bring those acres back into production without losing the valuable carbon sequestered in both the standing biomass and the soil.

*Recommendation:* Update the Conservation Practice Standard GHG Ranking Tool to properly reflect the climate benefits of perennial vegetation associated with pasture and rangeland management. Intensive rotational grazing and prescriptive grazing offer soil health benefits through reduced erosion, in addition to numerous climate co-benefits such as carbon sequestration and avoided greenhouse gas emissions from anaerobic manure decomposition. CPS 528 Prescriptive Grazing should be added to the Ranking Tool to reflect these benefits. Similarly, there are several CSP enhancements that address rotational grazing, which rank among the top-scoring conservation activities (ANM 37, PLT 16, ANM 21). NRCS should make a concerted effort to promote these practices and work with producers to transition to pasture-based systems.

**(3) NRCS conservation programs should prioritize systems and conservation activities that build soil organic matter, increase carbon sequestration, and prevent denitrification.**

---

[8] Bakker, E.S., M.E. Ritchie, H. Olff, D.G. Milchunas, J.M.H. Knops. 2006. Herbivore impact on grassland plant diversity depends on habitat productivity and herbivore size. 2006. Ecology Letters 9: 780-788.

[9] Parton, W.J., D.S. Ojima, D.S. Schimel. 1994. Environmental change in grasslands assessment using models. Climatic Change 28:111–141.

[10] Conant, R.T., K. Paustian, E.T. Elliot. 2001. Grassland management and conversion into grassland: effects on soil carbon. Ecological Applications 11:343–355; Liebig, M.A., J.A. Morgan, J.D. Reeder, B.H. Ellert, H.T. Gollany, G.E. Schuman. 2005. Greenhouse gas contributions and mitigation potential of agricultural practices in northwestern USA and western Canada. Soil Tillage Research. 83: 25-52.

[11] Perry, A. 2011. Putting Dairy Cows Out to Pasture: An Environmental Plus. Agricultural Research. May/June: 18-19. http://www.ars.usda.gov/is/AR/ archive/may11/

[12] Phetteplace, H.W., D.E. Johnson, A.F. Seidl. 2001. Greenhouse gas emissions from simulated beef and dairy livestock systems in the United States. Nutrient Cycling in Agroecosystems. 60: 99-102.

[13] Bannink, A., M.C.J. Smits, E. Kebreab, J.A.N. Mills, J.L. Ellis, A. Klop, J. France, J. Dijkstra. 2010. Simulating the effects of grassland management and grass ensiling on methane emission from lactating cows. Journal of Agricultural Science. 148:55-72.

Among the soil management practices that have the greatest potential to sequester carbon are reductions in synthetic fertilizer use, cover cropping, perennial plantings, and conservation tillage.[14] Studies suggest that a combination of soil management practices – not any one practice – offer the best opportunities to build soil organic matter and sequester carbon.[15] This is already reflected in the NRCS Soil Health Initiative, which combines increased year round soil coverage, increased living roots in the soil profile, reduced soil disturbance, and increased crop diversity (especially multispecies cover crops) to optimize soil health and net carbon sequestration in annual cropping systems. It is important to note that both chemical disturbance (anhydrous ammonia, high salt synthetic fertilizers, fumigation, heavy use of herbicides) and physical disturbance (tillage, traffic, overgrazing) can degrade soil health and lead to a net loss of soil carbon.

Cover crops have been found to increase soil carbon, on average, 1.5 to 4 times as much as land under cultivation.[16] Composting and the addition of organic amendments have also resulted in increased carbon storage in soils.[17] Practices to increase carbon sequestration may influence the nitrogen cycle of the soil and lead to short-term increases in nitrous oxide emissions. For example, USDA researchers in Maryland when comparing the total carbon footprint of three different grain systems found that the organic grain system in some years had higher nitrous oxide emissions compared to conventional no-till and chisel plow grain systems. However, when comparing the total emissions of the three systems, looking at nitrous oxide emissions, carbon content of soils and fossil fuel consumption, the organic system had lower overall emissions compared to the two conventional systems, despite the higher nitrous oxide emissions in the organic system.[18]

Diverse cropping systems not only help to spread out risk of climate-related crop failures, but also provide significant conservation benefits. Resource-conserving crop rotations produce high yields, control pests and weeds with less reliance on pesticides, and enhance soil fertility with less need for chemical fertilizers.[19]

***Recommendation:*** Integrate the principles of the Soil Health Initiative, with the added perspective on chemical and physical soil disturbance, into both working lands programs (EQIP and CSP) and easement programs (ACEP). Once the Greenhouse Gas Ranking Tool is updated, NRCS could overlay those practices that rank high on the list with the most suitable practices for a CSP or EQIP applicant. NRCS could also overlay those practices with the practices promoted through the Soil Health Initiative, to demonstrate the climate co-benefits of soil health-enhancing activities. Finally, NRCS could use the Soil Health Initiative to increase promotion and education of the supplemental payment option for Resource-Conserving Crop Rotations through CSP.

---

[14] Paustian, K., H.P. Collings, E.A. Paul. 1997. Management controls on soil carbon (chapter). Soil organic matter in temperate agroecosystems. CRC Press. Boca Raton, FL, USA.
[15] De Gryze, S., R. Catala, R.E. Howitt, J. Six. 2008. Assessment of Greenhouse Gas Mitigation in California Agricultural Soils. California Energy Commission. PIER Energy-Related Environmental Research. CEC-500-2008-039
[16] Steenwerth, K. and K.M. Belina. 2008. Cover crops enhance soil organic matter, carbon dynamics and microbiological function in a vineyard agroecosystem. Applied Soil Ecology. 40: 359-369.
[17] Lal, R., J. Kimble, E. Levine, B.A. Stewart (eds). 1995. Soil management and the greenhouse effect. Boca Raton, FL, USA. Lewis Publishers.
[18] Cavigelli, M., M. Djurickovic, C. Rasmann, J. Spargo, S. Mirsky and J. Mail. 2009. Global warming potential of organic and conventional grain cropping systems in the mid-Atlantic region in the U.S. In Proceedings of the Farming Systems Design Conference. Monterey, California. 51-52.
[19] Davis AS, Hill JD, Chase CA, Johanns AM, Liebman M (2012) Increasing Cropping System Diversity Balances Productivity, Profitability and Environmental Health. PLoS ONE 7(10): e47149. doi:10.1371/journal.pone.0047149

*Recommendation:* When ranking applicants for NRCS program, assessments of the conservation or environmental benefits index of different conservation activities should take net greenhouse gas emission and sequestration into account. Moreover, applicants for NRCS conservation programs should be made aware of the climate-specific benefits of various activities.

*Recommendation:* Increase incentives for the use of legumes and organic inputs, like compost and manure, for nitrogen, as well as other conservation practices that reduce the use of synthetic nitrogen and improve management of unstable organic nitrogen. CSP includes enhancements that address this issue, such as ENR10 (Using N provided by legumes, animal manure, and compost) and ENR12 (Use of legume cover crops as N source), and applications containing these practices should be prioritized.

**(4) NRCS should promote farmscaping that supports resilience to a changing climate and promotes carbon sequestration in woody biomass and soils.**

Farmscaping includes a broad range of management practices that involve planting various tree, shrub, and grass species within agricultural landscapes to maximize the ecosystem services provided to the adjacent farmland and the wider environment. Production crops can be annual or perennial; farmscaping plants are often a combination of annuals, herbaceous perennials, and woody perennials. Incorporating trees, shrubs or other types of woody vegetation into rangeland or farm landscapes can help sequester carbon and nitrogen in significant quantities. Carbon dioxide and nitrogen are absorbed by the trees and plants and stored in the woody biomass above ground and in the root system. One study in California found that hedgerows and planted riparian corridors store 18 percent of the farm-based carbon while occupying only 6 percent of the landmass.[20]

Woody vegetation enhances streambank stabilization and water quality, and decreases sedimentation problems downstream caused by increased flooding events. These woody plants increase infiltration and groundwater recharge,[21] especially important in areas experiencing drought. Riparian vegetation buffers can also mitigate the impacts of climate change by stabilization of stream flow,[22] and reduction of stream temperatures.[23]

Farmscaping with woody vegetation such as windbreaks and shelterbelts can reduce wind-related effects of climate change. For crop fields, evapotranspiration is decreased, thus reducing crop moisture stress.[24] For fields fallowed because of drought conditions, these practices can reduce wind-induced soil erosion. Windbreaks and hedgerows can also be harvested, which expands market options for a farmer whose options may have been narrowed due to an inability to raise the same cash crops as in the past.

---

[20] Smukler, S.M., S. Sanchez-Moreno, S.J. Fonte, H. Ferris, K. Klonsky, A. T. O'Genne, K.M. Scow, K.L. Steenwerth, and L.E. Jackson. 2010. Biodiversity and multiple ecosystem functions in an organic farmscape. Agriculture, Ecosystems and Environment. 139: 80-97

[21] Palmer, M. A., D. P. Lettenmaier, N. L. Poff, S. L. Postel, B. Richter, and R.Warner (2009). "Climate Change and River Ecosystems: Protection and Adaptation Options." Environmental Management 44(6).

[22] Chien, H. a. J. K. (2010). The relationship between stream flow, riparian buffers, and climate change in an agricultural landscape. American Geophysical Union, American Geophysical Union. abstract #GC51I-0836.

[23] Bowler, D. E., R. Mant, H. Orr, D. M. Hannah and A. S. Pullin (2012). "What are the effects of wooded riparian zones on stream temperature?" Environmental Evidence 1(3).

[24] Easterling, W. E., C. J. Haysa, M. McKenney Easterling, and J. R. Brandle (1997). "Modelling the effect of shelterbelts on maize productivity under climate change: An application of the EPIC model." 61(2-3): 163-176.

In drought conditions, pollinators benefit from flowering shrubs and trees that are native and drought tolerant since less water is needed than for flowering ornamentals. Climate change will drive increases in pest populations,[25] and the need for greater pesticide usage can be mitigated by woody vegetation that enhances biological pest control. Rising temperatures may cause increased torrential rains and flooding which results in increased rodent populations. Trees with roosts for raptors, and wildlife corridors for other terrestrial predators of rodents will help to control rodent populations and thereby build resilience on the agricultural lands.

Invasive species are predicted to increase as the planet warms due to their ability to disperse quicker than natives in human landscapes.[26] Replacing annual weeds with hedgerows reduces the cost, energy, and carbon emissions from continual management of the weedy species with herbicides or tractor work. In addition, hedgerows of woody perennials can attract more beneficial insects than pest insects, while weedy areas tend to do the opposite, attracting significantly more pests than beneficial insects.[27]

Using drought -tolerant native plants that are adapted to local regions reduces the water requirement to only that needed during the plant's establishment phase. As water becomes scarce in some regions of the country, especially the arid West, it will be important to balance the carbon and other benefits of trees and woody plants with the water needs of such plantings though, even in this region, riparian vegetation will be necessary for functioning ecosystems. Thus, it becomes increasingly important to take a regional approach to conservation plans that consider both mitigation and adaptation needs.

***Recommendation:*** Update the Conservation Practice Standard GHG Ranking Tool to properly reflect the climate benefits of perennial vegetation. In particular, CPS 332 Contour Buffer Strips, 386 Field Border, 422 Hedgerow, 393 Filter Strip, and 412 Grassed Waterways all entail establishing herbaceous (or sometimes shrubby) perennial vegetation on part of the field, as do 603 Herbaceous Wind Barriers and 589 Cross Wind Trap Strips, which should also be included in an update of the Ranking Tool to fully reflect the climate benefits of perennial vegetation.

***Recommendation:*** Consider the relative benefits of woody biomass to herbaceous biomass at the farm level. Planting trees and tall shrubs may appropriately be valued higher than perennial grasses and forbs – a differential appropriately reflected in CPS 391 Riparian Forest Buffer (ranked in the second tier) and CPS 392 Riparian Herbaceous Buffer (ranked in the third tier), but it all depends on how much area is planted. Trees and tall shrubs sequester the most above-ground carbon in their substantial and long-lived woody biomass, while deep-rooted native perennial grasses and other prairie plants sequester large amounts of carbon throughout the soil profile, with a long residence time. In both cases, the mitigating effect is directly proportional to how much area is planted.

---

[25] UC Davis. How does climate change affect agricultural pests and disease? Agricultural Adaption to Climate Change in Yolo County. (accessed 5/26/14) http://agadapt.ucdavis.edu/pestsdiseases/

[26] Hansen, A. J., R. P. Neilson, V. H. Dale, C. H. Flather, L. R. Iverson, and S. S. D. J. Currie, R. Cook, P. J. Bartlein (2001). "Global Change in Forests: Responses of Species, Communities, and Biomes: Interactions between climate change and land use are projected to cause large shifts in biodiversity." Bioscience 51(9).

[27] Morandin, L. R. F. L., C. Pease, and C. Kremen (2011). "Hedgerows enhance beneficial insects on farms in California's Central Valley." California Agriculture October-December.

*Recommendation:* Consider the regional appropriateness when comparing and ranking conservation activities. In some arid and drought-prone regions, for example, increased plantings and their carbon benefits should be weighed against increased demands for water and impacts on small water systems. When promoting these practices, it will be necessary to take a regional perspective.

**(5) NRCS should encourage practices that reduce methane emissions, especially in livestock systems.**

Livestock in many regions can account for more than half of agriculture's GHG emissions. The sources of livestock emissions include gases emitted directly from animals (enteric fermentation), manure management, and emissions associated with feed, energy and water use during livestock production. However, there are many alternatives to the feedlot model that help producers mitigate and adapt to climate change effects.

Sustainable management of rangelands can be an effective tool for carbon sequestration and GHG emission reduction generally. When properly managed, rotational cattle grazing, such as mob grazing which simulates the grazing behavior of bison and other wild ruminants, can increase above-ground productivity of vegetation and species richness,[28] which is frequently correlated with increased carbon in soil.[29] Grazing has also been found to increase the rate of soil carbon sequestration.[30]

Livestock grazing on high-quality forage or on a diet containing plants typically found in pastures may emit less methane. While research comparing methane emission from pasture versus feedlot finishing are still limited, evidence suggest that finishing cattle on pasture rather than on grain may reduce methane emissions.[31] Studies comparing the energy inputs required for different livestock management systems also suggests that conventional feedlot livestock require twice as much fossil fuel energy inputs compared to grass-fed livestock.[32] Moreover, when manure is applied to the land instead of stockpiled or stores in lagoons, methane emissions can be reduced.[33]

*Recommendation:* Promote optimum pasture-based systems, such as rotational grazing and mob grazing systems, that enhance aboveground and belowground plant biomass and distribute manure over large areas rather pilling up unusable amounts of manure. Confinement and pasture-based systems have different rates of enteric fermentation, and NRCS practices and approaches should recognize those differences and work to promote and assist producers in the transition from confinement to pasture-based livestock systems.

---

[28] Bakker, E.S., M.E. Ritchie, H. Olff, D.G. Milchunas, J.M.H. Knops. 2006. Herbivore impact on grassland plant diversity depends on habitat productivity and herbivore size. Ecology Letters. 9: 780-788.
[29] Parton, W.J., D.S. Ojima, D.S. Schimel. 1994. Environmental change in grasslands – assessment using models Climate Change. 28: 111-141.
[30] Conant, R.T. K. Paustian, E.T. Elliot. 2001 Grassland management and conversion in grassland: effects on soil carbon. Ecological Applications. 11:343-355.
[31] Cohen, R.D. H., J. P. Stevens, A.D. Moore, J.R. Donnelly, M. Freet. 2004. Predicted methane emissions and metabolizable energy intakes of steers grazing a grass/alfalfa pasture and finished in a feedlot or at pasture using the GrassGro decision support tool. Canadian Journal of Animal Science. 84: 125-132.
[32] Pimetel, D. and M. Pimentel. 2008. Livestock production and energy inputs. Food, Energy and Society. Third Edition. CRC Press.
[33] Amon, B., V. Kryvoruchko, T. Amon, S. Zechmeister-Boltenstern. 2006. Methane, nitrous oxide and ammonia emissions during storage and after application of dairy cattle slurry and influence of slurry treatment. Agriculture Ecosystems and Environment. 112: 153-162

*Recommendation:* NRCS should not support CAFO expansion through its financial assistance programs. Financial assistance should be limited to mitigating the environmental problems of existing CAFOs, without expansion or new development.

**(6) NRCS should prioritize conservation easements on lands that currently provide climate benefits, including increased carbon sequestration and avoided greenhouse gas emissions, and that are most at risk of conversion to development or transportation uses that would greatly increase net greenhouse gas emissions.**

Fundamental to achieving climate benefits from agriculture is the conservation of its land base. Protecting farmland and open space – particularly lands near urban areas where development pressures will be highest – has a direct nexus with reducing greenhouse emissions related to transportation and development. Recent studies have found that preserving farmland and preventing sprawl development avoids significant increases in greenhouse gas emissions associated with transportation and developed land. [34] The UC Davis study compares emissions from an acre of farmland in Yolo County, California to an acre of urban land in the county. They found that GHG emissions from the acre of urban land emitted 70 times more than the acre of irrigated cropland. [35]

Strategic Goal 2 of USDA's Climate Change Adaptation Plan is to ensure that national forests and private working lands are "conserved, restored, and made more resilient to climate change while enhancing our water resources."[36] USDA extends this goal to forest, farm, ranch, and grass land. The new Regional Conservation Partnership Program (RCPP) is an ideal vehicle to move this goal forward by prioritizing projects that address climate change adaptation and mitigation through targeted conservation projects.

During the deliberations that led to the 2014 Farm Bill, Senators Whitehouse and Udall introduced an amendment that would have made climate change mitigation an explicit purpose of the RCPP. Due to a procedural rule, the amendment was not offered on the floor for vote. However, there is nothing in the bill that prevents NRCS from establishing climate change mitigation and adaptation as a recognized purpose of the program. In fact, the final bill states that a purpose of RCPP is to "further the conservation, restoration, and sustainable use of soil, water, wildlife, and related natural resources on eligible land on a regional or watershed level." Moreover, the farm bill grants the Secretary considerable discretion to establish eligible program activities, specifically including those related to drought mitigation, flood prevention, erosion control, and "other related activities that the Secretary determines will help achieve conservation benefits." This discretion, coupled with the President's clear directives to support climate change mitigation and adaptation across all federal

---

[34] *See* Jackson, L.E., F. Santos-Martin, A.D. Hollander, W.R. Horwath, R.E. Howitt, J.B. Kramer, A.T. O'Geen, B.S. Orlove, J.W. Six, S.K. Sokolow, D.A. Sumner, T.P. Tomich, and S.M. Wheeler. 2009. Potential for adaptation to climate change in an agricultural landscape in the Central Valley of California. California Energy Commission, PIER. CEC-500-2009- 044-F. http://www.energy.ca.gov/2009publications/CEC-500-2009-044/CEC-500-2009-044-F.PDF; Wassmer, R.W. Sept. 2008. California's Farmland Preservation Programs, Taxes, and Furthering the Appropriate Safeguarding of Agriculture at the Urban Fringe to Reduce Greenhouse Gas Emissions. CSU Sacramento. http://www.csus.edu/indiv/w/wassmerr/CAFarmLandUse.pdf

[35] *Id.*

[36] USDA Climate Change Adaptation Plan at 2.

program areas and USDA's goal to "lead efforts to mitigate and adapt to climate change"[37] presents a strong case for NRCS to take this action.

*Recommendation:* When selecting lands for enrollment in the new agricultural easement program, prioritize conservation easements on lands that provide climate benefits, including increased carbon sequestration and avoided transportation and development-related greenhouse gas emissions. In particular, farmland preservation should be focused on those farms with the strongest soil health management practices. Moreover, consider RCPP as a means to accomplish USDA's strategic goals through highly-targeted restoration of water resources through easement programs.

*Recommendation:* Include climate change mitigation and adaptation as an express purpose under RCPP. The current RCPP request for project proposals does not do so, but this change could be made in the next fiscal year call for funding. In the meantime, under existing authority, projects can still be prioritized based on their climate benefits.

**(7) When promoting conservation activities for their climate change benefits, NRCS should ensure that both the adaptation and mitigation benefits are assessed and appropriately reflected.**

Many conservation practices in agriculture can offer both climate change mitigation and adaptation benefits. For example, improving water use efficiency and conservation in irrigated cropland through drip irrigation with scheduling, improved soil management, on-farm ponds, and more can support growers who face constrained water resources as snowpack declines. Improving on-farm water use efficiency and conservation can also reduce energy used to move water to irrigated cropland, providing a GHG emission reduction.

Conservation practices and farming systems that provide these duel benefits of adaptation and mitigation to climate change should be prioritized in federal conservation programs. And where there are trade-offs – where a practice may help reduce GHG emissions but perhaps reduces resilience to climate change or vice versa – such trade-offs should be noted and considered.

*Recommendation*: Use the new regional climate hubs to review NRCS practice standards that may provide both adaptation and mitigation benefits at the regional level, expanding upon and deepening the work of the NRCS greenhouse emissions ranking tool. These practice standards should measure and promote practices based on an assessment of both their adaptation and mitigation benefits and considering variations in regional appropriateness.

**(8) In the implementation of conservation programs, NRCS should account for and work to reduce the impacts of climate change on terrestrial and aquatic habitats and ecosystem services, such as clean air and water.**

The Third National Climate Assessment contains stark warnings about the impacts of climate change on ecosystems and biodiversity. Climate change will reduce natural systems' "ability to improve water quality and regulate water flows," "overwhelm the capacity of ecosystems to buffer the impacts of extreme events like fires, floods, and storms," and may cause species to "disappear

[37] *Id.* at Objective 2.2.

from places where they have been prevalent.”[38] The suite of NRCS conservation programs have played a crucial role in conserving ecosystems and species, improving water quality, protecting wetlands and riparian areas, controlling invasive species, creating and enhancing connectivity and networks, and conserving and enhancing important wildlife habitats and landscapes. To maintain their effectiveness in this important role, these programs will need to give additional consideration to how climate change will impact program delivery and outcomes.

*Recommendation:* We urge USDA to use the opportunity of new rulemakings associated with the conservation program changes to maximize the ability of NRCS conservation programs to deliver resilience in the face of climate change for wildlife and natural resources. Such changes may include updating program priorities, additional considerations in conservation plans, updating practices and ranking criteria, and more outreach to encourage wider adoption of conservation activities that enhance the resilience of natural resources in the face of climate change.

Thank you for your consideration of our views. We look forward to the opportunity to continue working together to build a more resilient U.S. agriculture.

Ferd Hoefner
Policy Director

Sophia Kruszewski
Policy Specialist

The following NSAC members contributed significantly to these principles and recommendations:

Jo Ann Baumgartner, Wild Farm Alliance
Traci Bruckner, Center for Rural Affairs
Aimee Delach, Defenders of Wildlife
Jeanne Merrill, California Climate and Agriculture Network
Ralph Rosenberg, Iowa Environmental Council
Duane Sand, Iowa Natural Heritage Foundation
Jeff Schahczenski, National Center for Appropriate Technology
Mark Schonbeck, Virginia Association of Biological Farming

[38] Melillo et al. 2014.

## References


Benbrook, C, C Carman, E A Clark, C Daley, W Fulwider, M Hansen, C Leifert, K Martens, L Paine, L Petkewitz, G Jodarski, F Thicke, J Velez and G Wegnerune. 2010. A Dairy Farm's Footprint: Evaluating the Impacts of Conventional and Organic Farming Systems. The Organic Center.

Cavigelli, Mi. et al. 2013. Organic grain cropping systems to enhance ecosystem services. Renewable Agriculture and Food Systems 28(2): 145-149.

Davis AS, Hill JD, Chase CA, Johanns AM, Liebman M. 2012. Increasing Cropping System Diversity Balances Productivity, Profitability and Environmental Health. PLoS ONE 7(10): e47149. doi:10.1371/journal.pone.0047149 (Cropping system diversification promotes ecosystem services that can supplement, and eventually displace, synthetic external inputs used to maintain crop productivity. Through a balanced portfolio approach to agricultural sustainability, cropping system performance can be optimized in multiple dimensions, including food and biomass production, profit, energy use, pest management, and environmental impacts.)

De Gryze, S, R Catala, R E. Howitt, and J Six. 2009. Assessment of greenhouse gas mitigation in California agricultural soils (California Climate Change Center Report Series Number 2008-004 CEC-500-2008-039). UC Davis.

De Gryze, S., et al. 2010. Simulating greenhouse gas budgets of four California cropping systems under conventional and alternative management. Ecological Applications, Vol. 20, No. 7, pages 1805-1819. October 2010.

Executive Order 13653, Preparing the United States for the Impacts of Climate Change, 78 Fed. Reg. 66819 (Nov. 6 2013).

LaSalle, T. and P. Hepperly. 2008. Regenerative organic farming: a solution to global warming. Report attached. (In a long-term (30 year) trial, both organic methods and reduction in tillage enhanced SOC levels. Highest carbon sequestration was under organic management with tillage reduced to the minimum feasible without synthetic herbicides.)

Marriott, E.E. and M.M. Wander. 2006. Total and labile soil organic matter in organic and conventional farming systems. Soil Science Society of America Journal 70: 950-959. (Long term rotations that included some perennial sod crops more than offset the effects of more tillage in organic versus conventional farming systems.)

Melillo, JM, TC Richmond, and GW Yohe (eds.). 2014. Highlights of Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program.

Nadia El-Hage Scialabba and Maria Muller-Lindenlauf 2010. Organic agriculture and climate change. Renewable Agriculture and Food Systems: 25(2); 158–169.

NRCS. 2010. Effects of conservation practices on cultivated cropland in the Upper Mississippi River Basin. USDA-NRCS.

Soil Association. 2009. Soil Carbon and Organic Farming: A review of the evidence on the relationship between agriculture and soil carbon sequestration, and how organic farming can contribute to climate change mitigation and adaptation. November 2009.

Teasdale, J.R. 2007. No Shortcut in Checking Soil Health. Agricultural Research Magazine 55(6) (July 2007) http://www.ars.usda.gov/is/AR/archive/jul07/soil0707.htm. (After 9 years in different production systems, soil that had been under organic management with some tillage had higher SOC than soil under continuous no-till non-organic. The organic-managed soil also supported higher grain corn yields during three years subsequent to the production systems trial.)

Teasdale, J.R., C.B. Coffman, and R.W. Mangum. 2007. Potential long-term benefits of no-tillage and organic cropping systems for grain production and soil improvement. Agronomy Journal 99:1297-1305. (Refereed journal article covering the same information as the last reference.)
The President's Climate Action Plan, Executive Office of the President June 2013, http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf

USDA Climate Change Adaptation Plan, June 2012, available at http://www.usda.gov/oce/climate_change/adaptation/USDA%20Climate%20Change%20Adaptation%20Plan_Only.pdf

USDA Climate Change and Agriculture in the United States: Effects and Adaptation, CCPO Technical Bulletin, Feb. 2013.

USDA Natural Resources Conservation Service Climate Change Vulnerability Assessment and Adaptation Plan, May 2012, available at http://www.usda.gov/oce/climate_change/adaptation/Natural%20Resources%20Conservation%20Service.pdf